INSTRUCTION MANUAL

EMPIRE*

TUNING UNIT

~~150~~ 14 KC TO ~~30 MC~~ 150 KC

MODEL TX/ NF-105

Gertsch*
EMPIRE*
Sensitive Research*
Panoramic*
SINGER

*A Trademark of THE SINGER COMPANY

Precision electrical and electronic instruments for measurement

THE SINGER COMPANY • METRICS DIVISION

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4. Test instruments used
5. Approximate date instrument was placed in operation
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7. Has maintenance action been previously requested?
8. Other comments

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(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.

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1. GENERAL

Tuning Unit Model T-X/NF-105 covers the frequency range from 14 KC to 150 KC in three bands. It houses, in addition to the RF and IF circuits, an impulse generator covering the above frequency range and a 20 DB attenuator (sensitivity) switch.

The impulse generator serves as the calibrating source for the unit and the 20 DB attenuator switch enables the operator to increase the sensitivity of the unit by 20 DB.

The impulse noise bandwidth of Tuning Unit Model T-X/NF-105 is approximately 2.0 KC. The exact value of bandwidth (in megacycles) for any frequency may be found by referring to the calibration chart shown in figure 1 and dividing the carrier sensitivity (100 uv) by the equivalent impulse level. For example:

$$\frac{100\ \mu V}{94\ DB\ MC} = \frac{100\ \mu V}{50{,}000\ \mu V} = 0.002 = 2\ KC$$

2. ACCESSORIES

The accessories for Tuning Unit T-X/NF-105 are included in the Antenna Equipment LX-105 which consists of the following items.

Carrying Case	XC-105
Loop Antenna	LG-105
Vertical Antenna	VX-105
Line Probe (50 ohms)	LB-105

All items included in Antenna Equipment LX-105 are housed in Carrying Case XC-105.

A remote vertical antenna is available as an optional item. It consists of a whip base (VR-105), a ground ring for mounting to the Broadband Antenna Plane (BB-105) and an adapter for use with the Broadband Antenna Rods. The remote vertical antenna base when used with the 41 inch collapsible rod is referred to as VR-1 and when used with the adapter and Broadband rods it is referred to as VR-3.

The input impedance of the NF-105 is 50 ohms for all frequencies. In order to achieve efficient energy transfer from the various pick-up devices, matching couplers are furnished.

The loop antenna LG-105 consists of a shielded loop, 36 inches in diameter, mounted on a base containing the impedance matching coupler. A three band coupler, selectable by a switch, matches the low impedance loop to the 50 ohm output terminal. Calibration by the series injection method has not been provided in this loop.

Loop LG-105A is available with the series injection feature. In addition a single broadband matching coupler is used, thus eliminating the need for the band switch.

The vertical antenna VX-105 consists of a 41" collapsible rod attached to a UHF connector adapter. This adapter mates with the connector on the front panel of the Tuning Unit. The choices are available for attaching the 41 inch whip to the adapter. One choice provides a vertical antenna which is in the same plane as the front panel of the Tuning Unit. The other choice provides a horizontal antenna which is at a right angle to the front panel of the Tuning Unit. The matching coupler for this antenna is a continuously tuned device, contained within the Tuning Unit and ganged to the tuning dial.

The remote vertical antenna VR-105 consists of a whip base, containing a single broadband impedance matching coupler. Calibration by the series injection method has been included in this unit. The vertical antenna length is 41 inches in the VR-1 or 9 feet in the VR-3.

Line Probe LB-105 is designed for 50 ohms impedance. It is used in the same manner as line probes LL-105 and LH-105, as described in the NF-105 instruction manual for the higher frequencies.

3. INTERCONNECTIONS

a. Using VERTICAL ANTENNA VX-105

Figure 1 shows the interconnections using the T-X head with the VX-105 Vertical Antenna. This antenna is connected to the terminal on the head marked "VERT. ANT." The 6" patch cord connects the terminal on the head marked "TO ATTENUATOR" to the terminal on the main unit marked "ATTEN. OUTPUT". For operation, the 18" patch cord connects the terminal on the head marked "TO SIG. INPUT" to the terminal on the main unit marked "SIGNAL INPUT". For calibration, disconnect one end of the patch cord from the terminal marked "TO SIG. INPUT" and connect it to the terminal marked "IMPULSE GEN. OUTPUT".

b. Using Loop Antenna LG-105

Figure 2 shows the interconnections using the T-X head with the LG-105 Loop Antenna. This antenna has a band switch, whose position must be selected to correspond to the frequency band chosen in the head. The 6" patch cord connects the terminal on the head marked "TO ATTENUATOR" to the terminal on the main unit marked "ATTEN. OUTPUT". For operation, the 30 ft. cable connects the terminal on the main unit marked "SIGNAL INPUT" to the terminal on the loop antenna. For calibration, disconnect the 30 ft. cable from the "SIGNAL INPUT" terminal and connect the 18" patch cord from this terminal to the terminal on the head marked "IMPULSE GEN. OUTPUT".

c. Using Loop (LG-105A or Vertical Antenna (VR-105)

Figure 3 shows the interconnections using the T-X head with Loop Antenna LG-105A or Remote Vertical Antenna VR-105. These antennas have two common characteristics:

1. Series injection for calibration purposes,

2. A single broadband impedance matching coupler, covering the full frequency range.

The 6" patch cord connects the terminal on the head marked "TO ATTENUATOR" to the terminal on the main unit marked "ATTEN. OUTPUT". For operation, the pair of 30 ft. cables are used to connect the terminal on the head marked "IMPULSE GEN. OUTPUT" and the terminal on the main unit marked "SIGNAL INPUT" to the two terminals of the antenna in use. The color codes of the cable connectors and that of the terminals on the antennas must be observed as indicated in Fig. 3.

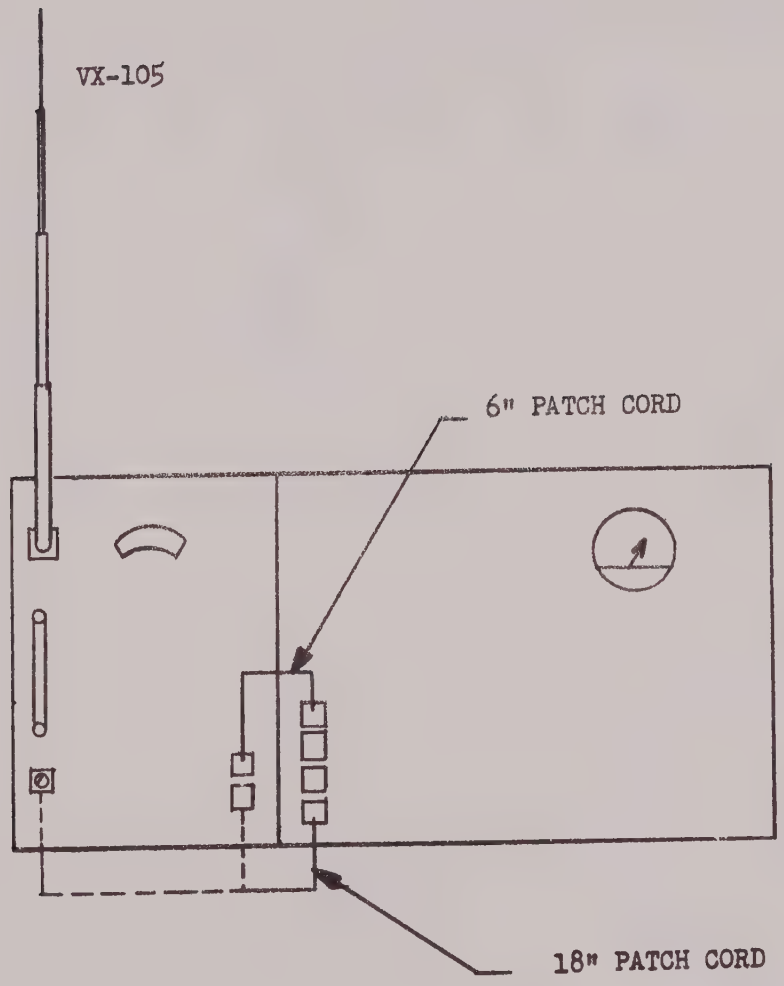


Fig. 1

INTERCONNECTIONS USING T-X HEAD

WITH VERTICAL ANTENNA VX-105

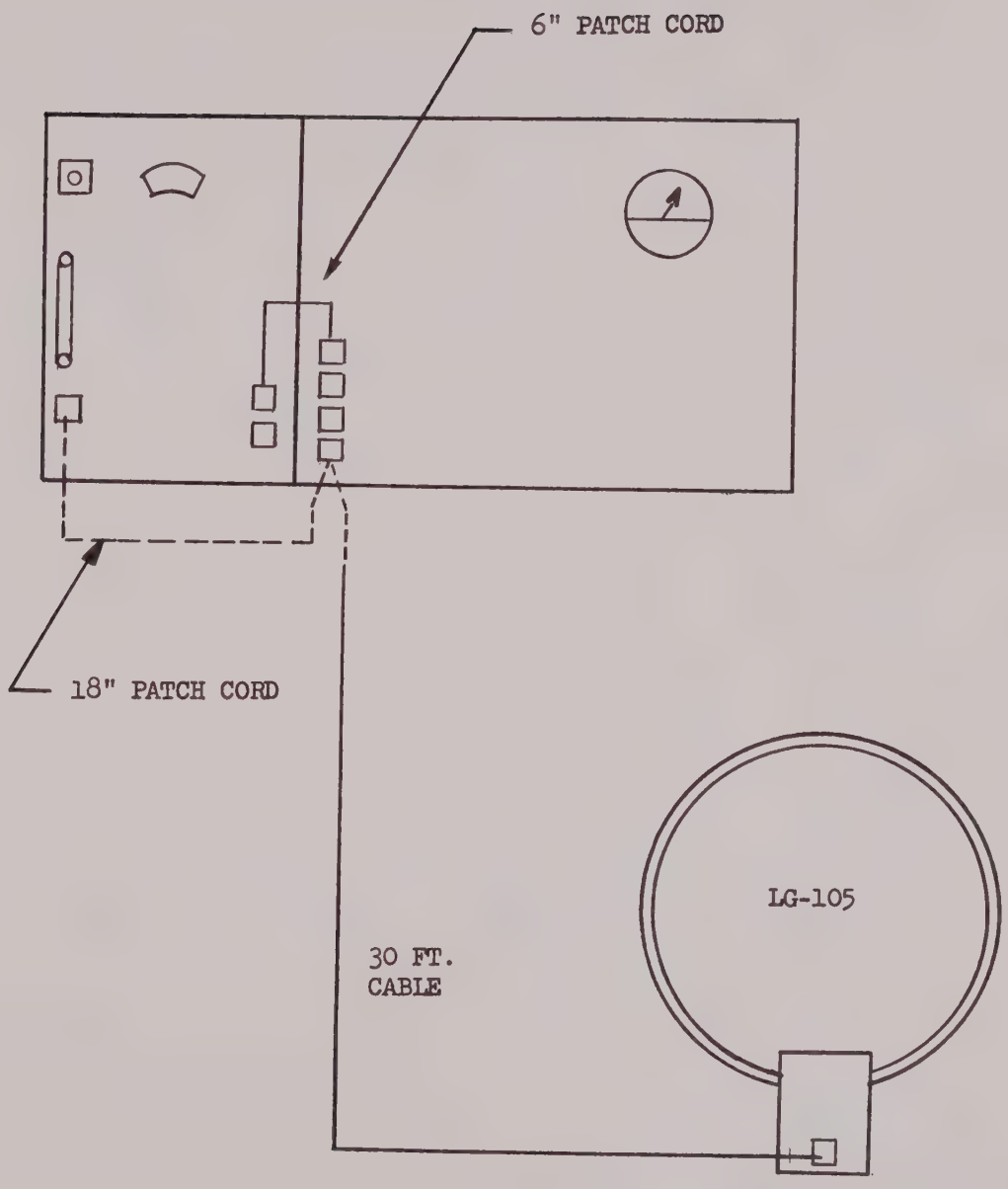


Fig. 2

INTERCONNECTIONS USING TX HEAD

WITH LOOP ANTENNA LG-105

4. CONDUCTED MEASUREMENTS

Calibrate the instrument as a two terminal voltmeter in accordance with the following procedure.

Connect the 6 inch patch cord from the terminal on the tuning unit marked "TO ATTENUATOR" to the terminal on the main unit marked "ATTEN. OUTPUT". Connect the 18 inch patch cord from the terminal on the tuning unit marked "IMPULSE GEN. OUTPUT" to the terminal on the main unit marked "SIGNAL INPUT."

Turn the equipment on and after it has warmed up, adjust the meter balance and zero adjust controls for meter zero. Turn the IMPULSE GENERATOR ON-OFF switch located in the tuning unit to the "ON" position. This impulse generator has a fixed repetition rate of approximately 100 cycles per second.

For CW measurements, adjust the IMPULSE GENERATOR OUTPUT LEVEL control to the value indicated for the desired frequency. (See figure 4).

Set the "-20 DB - NORMAL" switch, located on the tuning unit, to "NORMAL". Set the SIGNAL INPUT attenuator to 20 DB. Turn the band switch on the tuning unit to the proper frequency range and tune to the desired frequency. Turn the function switch to "PEAK" and adjust the "GAIN" control for a full scale indication on the large meter.

The instrument now has a full scale sensitivity of 100 microvolts (CW) as a two-terminal vacuum tube voltmeter. By changing the attenuator setting to 0, 40, 60 or 80 DB the full scale sensitivity is changed to 10, 1000, 10,000 or 100,000 microvolts, respectively, as shown in the table below. Calibration by means of the impulse noise signal must at all times be made with the function switch in the "PEAK" position, even though the instrument is being calibrated to be used for carrier measurements.

SIGNAL INPUT ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	10 mivrovolts
20 DB	100 microvolts
40 DB	1000 microvolts
60 DB	10,000 microvolts
80 DB	100,000 microvolts

The acutal level in DB above 1 uv impressed aqross the input terminal of the instrument is the SIGNAL INPUT ATTENUATOR setting plus the meter reading in DB.

TYPICAL CALIBRATION CHART FOR TUNING UNIT T-X/NF-105

SERIAL NO. 000

BAND	FREQUENCY (KC)	IMPULSE GEN. LEVEL IN DB ABOVE 1 uv/MC
1	14	94.0
	15	94.0
	16	94.0
	18	93.0
	20	93.0
	22	92.5
	24	92.0
	25	92.0
2	25	93.5
	30	92.5
	35	92.0
	40	92.0
	45	92.0
	50	92.0
	55	92.0
	60	92.0
3	62	93.0
	65	92.5
	70	92.0
	75	92.0
	80	92.0
	90	91.5
	100	91.5
	110	92.0
	120	92.5
	130	92.5
	140	92.5
	150	92.5

FIGURE 4

By placing the "-20 DB - NORMAL" switch in the "-20 DB" position, the full scale sensitivity is increased by 20 DB. The new calibration is shown in the following chart.

SIGNAL INPUT ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	1 microvolt
20 DB	10 microvolts
40 DB	100 microvolts
60 DB	1000 microvolts
80 DB	10,000 microvolts

The actual level in DB above 1μV impressed across the input terminals of the instrument is the SIGNAL INPUT ATTENUATOR setting minus 20 DB plus the meter reading in DB.

After the calibration has been performed, carrier measurements are normally taken with the function switch in the "CARRIER" position. Readings must be taken in the "PEAK" position, however, if the peak value of a modulated carrier is to be measured.

To make conducted interference measurements set up the equipment as shown in figure 5.

If a 40 DB increase in sensitivity is desired, the first 20 DB increase is achieved by employing the following calibration procedure. Place the "-20 DB - NORMAL" switch to "NORMAL". Set the SIGNAL INPUT ATTENUATOR to 40 DB instead of 20 DB while calibrating. This procedure provides the same full scale sensitivity as shown in the table above. The second 20 DB increase is achieved by placing the "20 DB - NORMAL" switch in the "-20 DB" position thus changing the full scale sensitivity as shown in the table below.

SIGNAL INPUT ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	0.1 microvolt
20 DB	1 microvolt
40 DB	10 microvolts
60 DB	100 microvolts
80 DB	1000 microvolts

The actual level in DB above 1μV impressed across the input terminals of the instrument is the SIGNAL INPUT ATTENUATOR setting minus 40 DB plus the meter reading in DB.

When the instrument is used with the SIGNAL ATTENUATOR in the "0 DB" position and the "-20 DB - NORMAL" switch in the "-20 DB" position, correction for residual noise may be applied as indicated in the instruction manual for the NF-105.

For peak measurements of broadband noise, the substitution method (visual or aural) is used as described in detail in the instruction manual for the NF-105. The readings of broadband noise are always in terms of DB above 1 microvolt per megacycle bandwidth.

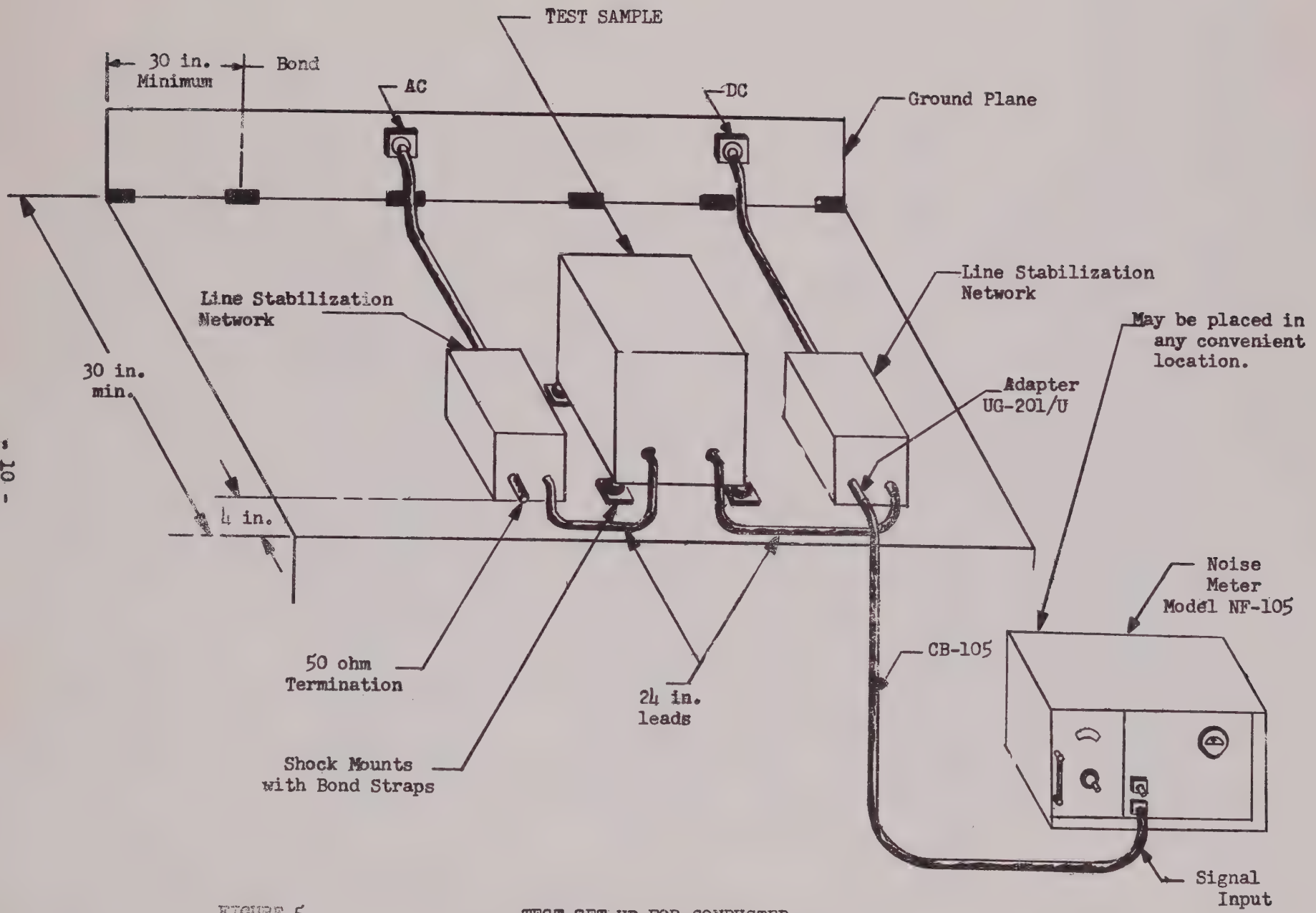


FIGURE 5

TEST SET-UP FOR CONDUCTED
INTERFERENCE MEASUREMENTS 14KC-150KC

5. RADIATED MEASUREMENTS

In order to make radiated measurements, Vertical Antenna VX-105, Remote Vertical Antenna VR-105, Loop Antenna LG-105 or Loop Antenna LG-105A are used as pick-up devices. If measurements are conducted in a shielded room, Vertical Antenna VX-105 is commonly employed.

If Vertical Antenna VX-105 or Loop Antenna LG-105 is used as a pick-up device, the shunt calibration method (calibration at the input terminals of the instrument) is applied. For Remote Vertical Antenna VR-105 or Loop Antenna LG-105A, series calibration (calibration signal in series with unknown) is used. The series calibration method has the advantage of not requiring a change of connections; however, an extra factor of 20 DB must be applied since the injection circuit in these antennas attenuates the calibrating signal by this amount.

To use Vertical Antenna VX-105, extend the antenna to its full length and connect it to the "VERT. ANT." jack on the tuning unit as shown in figure 1.

To use Loop Antenna LG-105, connect the 30 foot cable between the "SIGNAL INPUT" terminal on the main unit and the terminal on the loop antenna as shown in fig. 2.

Since Loop Antenna LG-105A and Remote Vertical Antenna VR-105 use series injection for calibration purposes, connect one 30 foot cable (color coded red) between the "IMPULSE GEN. OUTPUT" jack on the tuning unit and the red terminal of the antenna being employed and connect the other 30 foot cable (color coded green) between the "SIGNAL INPUT" jack on the main unit and the green terminal of the antenna as shown in figure 3.

a. Using Vertical Antenna VX-105 (Shunt Calibration)

Turn the equipment on and after it has warmed up, adjust the meter balance and meter zero control. Turn the "IMPULSE GEN." switch "ON". For CW measurements, set the "IMPULSE GEN. LEVEL" controls to the value indicated in figure 4 for the desired frequency. Set the "SIGNAL INPUT ATTENUATOR" to "40 DB" and the "-20 DB - NORMAL" switch to "NORMAL". Turn the bandswitch on the tuning unit to the proper range and tune to the desired frequency. Turn the function switch to "PEAK" and adjust the "GAIN" control for a full scale indication on the large meter.

The two terminal sensitivity is as follows:

SIGNAL INPUT ATTENUATOR	FULL SCALE SENSITIVITY
0 DB	1 microvolts
20 DB	10 microvolts
40 DB	100 microvolts
60 DB	1000 microvolts
80 DB	10,000 microvolts

The actual level in DB above 1 uV, impressed across the input terminals of the instrument is the "SIGNAL INPUT ATTENUATOR" setting, minus 20 DB, plus the meter reading in DB.

Narrow Band Vert Ant Shunt Cal

In order to read narrow band CW signals the antenna "factor" shown in figure 6 for the VX-105 must be added to the instrument reading. These antenna factors indicate the voltage transformation ratio in the matching transformers necessary to convert the antenna impedance to 50 ohms as required by the input impedance of the instrument. In order to simplify calculations the published antenna "factors" are 20 DB less than the true value. The actual transformation ratio is 20 DB greater than the number shown in fig. 6. However, since the instrument was sensitized by 20 DB, 20 DB was removed from the published antenna "factor". This will now provide the correct radiated reading as the sum of the vertical antenna VX-105 "factor", the SIGNAL INPUT ATTENUATOR and the meter indication.

Check by means of the tuning adjustment on the tuning unit, that the desired signal produces maximum meter deflection. It may be necessary to change the SIGNAL INPUT ATTENUATOR setting in order to achieve an "on-scale" meter reading. If in tuning to the signal to be measured, an appreciable departure from the original calibrating frequency was required, consult the calibration chart (figure 4), and if necessary, calibrate at a new frequency.

b. Using Loop Antenna LG-105 (Shunt Calibration)

Narrow Band Loop Ant Shunt Cal

Calibrate the instrument as a two terminal voltmeter following the procedure outlined in paragraph "a" above.

In order to read narrow band CW signals the antenna "factor" shown in figure 7 for the LG-105 must be added to the instrument.

TYPICAL ANTENNA "FACTOR"

FOR

VERTICAL ANTENNA VX-105

UNIT # 000

BAND	FREQUENCY (KC)	DB
1	14	29.2
	15	28.5
	16	28.3
	18	27.8
	20	27.5
	22	26.8
	24	26.8
	25	26.5
2	25	26.0
	30	25.7
	35	23.3
	40	21.2
	45	18.9
	50	18.1
	55	17.0
	60	16.0
3	62	22.5
	65	21.8
	70	21.2
	75	20.2
	80	19.2
	90	17.2
	100	15.5
	110	14.3
	120	13.2
	130	12.5
	140	11.8
	150	11.5

NOTE: For substitution measurements, add 20 DB to the above factors.
only if The instrument has NOT been sensitized by 20 DB.

FIGURE 6

ANTENNA "FACTOR"

FOR

LOOP ANTENNA LG-105

BAND	FREQUENCY (KC)	DB
1	14	37.7
	15	37.5
	16	37.4
	18	36.7
	20	36.3
	22	35.8
	24	35.2
	25	35.0
2	25	34.5
	30	34.2
	35	33.0
	40	32.0
	45	31.3
	50	31.5
	55	32.0
	60	32.0
3	62	30.5
	70	27.9
	80	25.5
	90	25.5
	100	26.0
	120	25.2
	140	26.5
	150	26.0

NOTE: For substitution measurements, add 20 DB to the above factors.

Same applies

FIGURE 7

reading. This will now provide the correct radiated reading as the sum of the Loop Antenna LG-105 "factor", the SIGNAL INPUT ATTENUATOR and meter indication.

Check by means of the tuning adjustment on the tuning unit that the desired signal produces maximum meter deflection. It may be necessary to change the SIGNAL INPUT ATTENUATOR setting in order to achieve an "on-scale" reading. If in tuning to the signal to be measured, an appreciable departure from the original calibrating frequency was required, consult the calibration chart (figure 4), and if necessary, calibrate at a new frequency.

c. Using Loop Antenna LG-105A and Remote Vertical Antennas VR-105 (shunt calibration)

Remote VERT ANT
Remote Loop ANT
shunt CAL

Calibrate the instrument using the same procedure outlined in paragraph "a" above.

In order to read narrow band CW signals the antenna "factor" shown in figure 8 for the applicable VR-105 antenna (VR-1 or VR-3) must be added to the instrument reading. This will now provide the correct radiated reading as the sum of the Remote Vertical Antenna VR-1 or VR-3 "factor", the SIGNAL INPUT ATTENUATOR and meter indication.

d. Broadband Noise Measurements

Broadband

For measurements of broadband noise, the substitution method (visual or aural) is used as described in the instruction manual for the NF-105. The readings of broadband noise are always in terms of DB above 1 microvolt per megacycle bandwidth. Add to the result of the substitution measurement, the antenna factors shown in figures 6, 7, or 8, plus a constant of 20 DB. When making broadband radiated measurements the substitution method must always be employed. In this method, the indication obtained from the unknown radiated signal is matched by the impulse generator contained in the tuning unit. The unknown radiated signal is picked up by the antenna and fed to the instrument through the antenna matching networks necessary to convert the antenna impedance. The substitution impulse generator signal, however, is fed directly to the input terminals of the instrument. The result

ANTENNA "FACTORS"

FOR

REMOTE VERTICAL ANTENNAS VR-1-105, VR-3-105

LOOP ANTENNA LG-105A

FREQUENCY (KC)	VR-1-105 (DB)	VR-3-105 (DB)	LG-105A (DB)
14	32.0	24.2	38.2
20	29.7	23.5	35.8
25	28.4	21.8	34.8
35	26.7	21.0	32.0
60	26.0	21.0	30.8
100	26.0	21.0	27.5
150	26.0	21.0	27.5

NOTE: For substitution measurements, add 20 DB to the above factors.

FIGURE 8

of this is that the full transformation ratio of the antenna matching networks must be added to the impulse generator level in order to indicate the true radiated signal appearing at the antenna. It is for this reason that substitution measurements taken with Tuning Unit T-X/NF-105 require the addition of 20 DB to the antenna "factor".

The series injection method of calibration can also be used for this measurement. See Fig. 3 for interconnections. Proceed as with the substitution method and adjust the instrument to a reference level for the unknown signal. Without disturbing the receiver controls, turn "ON" the "IMPULSE GEN." and adjust its level to produce the same reference indication. The total radiated signal in terms of DBMC is the level indicated by the IMPULSE GEN. OUTPUT dial settings minus 20 DB.

Broad band series

6. FIELD STRENGTH MEASUREMENTS

Field Strength measurements may be conducted utilizing either a vertical or loop antenna. Results obtained using a loop will be more accurate since they are essentially independent of ground consistency or height above ground. On the other hand, a disadvantage of the loop antenna, especially at lower frequencies, is its small effective height compared to that of a vertical antenna. For these reasons, use a loop antenna for field strength measurements whenever the signal level is sufficient to produce an adequate indication. Since the loop antenna is a directive device, it must be rotated for a maximum pickup as indicated by the meter.

If a low signal level makes the use of a vertical antenna necessary, it is recommended that for greater accuracy, the vertical antenna be calibrated by means of the loop antenna at or near the frequency to be measured.

The calibration procedure is the same as that described in the previous section on radiated measurements. In order to obtain field strength in DB above 1 microvolt per meter, refer to figure 6, 7 or 8 for the applicable antenna factors. Add 6 DB (the effective height of a 41 inch rod) to the readings obtained when using the antenna factor for the VX-105 or the VR-1-105 vertical antennas. Subtract 3 DB when using the antenna factor for the VR-3-105 remote vertical antenna.

Add 6 DB for 41" h.

7. SIG. ATT. ("-20 DB - NORMAL" Switch)

The SIG. ATT. switch marked "-20 DB/NORMAL" enables the sensitivity to be increased by 20 DB. That is; after calibration is made with the switch in the "NORMAL" position, the full scale reading of 1 μV may be changed to 0.1 μV by setting the switch to the "-20 DB" position.

8. CIRCUIT DESCRIPTION

Tuning Unit T-X/NF-105 covers the frequency range from 14 KC to 150 KC in three bands, using an IF frequency of 225 KC. It employs a Vertical Antenna (VX-105), Loop Antennas (LG-105) and (LG-105A) and a Remote Vertical Antenna (VR-105) as pick-up devices.

When the Vertical Antenna VX-105 is utilized, it is connected to the VERT. ANT. jack located on the front panel of the tuning unit. The signal from this jack connects directly to the high impedance point on the continuously tuned antenna input tuner. This tuner is ganged to the tuning dial and covers the full frequency range in three bands. The band switch also selects the low impedance winding of each tuner and feeds it to the connector (50 ohms impedance) on the front panel marked "TO SIG. INPUT". From this point the signal is patched over to the connector on the basic measuring unit marked "SIGNAL INPUT". After passing through the SIGNAL INPUT ATTENUATOR it feeds the connector on the basic measuring unit marked "ATTENUATOR OUTPUT". From this point the signal is patched back to the tuning unit via connector marked "TO ATTENUATOR".

The signal, now inside the tuning unit again, first passes through a low pass filter (f_c = 150 KC) to insure a high rejection to unwanted signals at the IF frequency and to unwanted high frequency spurious signals.

After the low pass filter, the signal is processed as a conventional superheterodyne receiver. That is, RF grid tuner, 6BA6 amplifier, RF plate tuner. local oscillator 6C4 and balanced modulator (germanium diodes). The IF frequency amplifier (225 KC) consists of four 6BJ6 tubes, three double tuned transformers and one bifiler output transformer. The signal from the IF amplifier feeds the final detector located in the basic measuring unit.

When Loop Antenna LG-105, LG-105A or Remote Vertical Antenna VR-105 is used, it is connected by means of the 30 ft. coaxial cable directly to the "SIGNAL INPUT" connector located on the basic measuring unit. The LG-105 antenna is matched to 50 ohms by means of a three band coupler located at the base of the loop. The LG-105A and the VR-105 antennas are matched to 50 ohms by means of a single broadband coupler located at the base of the antenna.

An impulse generator is contained in the tuning unit to provide the calibrating signal. This generator consists of a neon type relaxation oscillator (100 cps), a trigger amplifier (6BJ6) and a delay line pulse generator (2D21). The amplitude of this generator is controlled by a two dial attenuator capable of setting the level from 40 to 110 DBMC in 1 DB steps. Figure 9 is a block diagram of the tuning unit.

9. BFO

Assists in finding and tuning in unmodulated CW signals. It is controlled by a front panel toggle switch labeled "BFO", "ON" and "OFF". The BFO operates at a frequency of about 225.5 KC. This beats with the 225 KC - IF signal to produce an audible tone of about 500 cycles in the earphones when the tuning unit is tuned to an incoming signal.

CAUTION: The BFO must be in the OFF position when making measurements. It is to be used only to assist in the tuning of the signal.

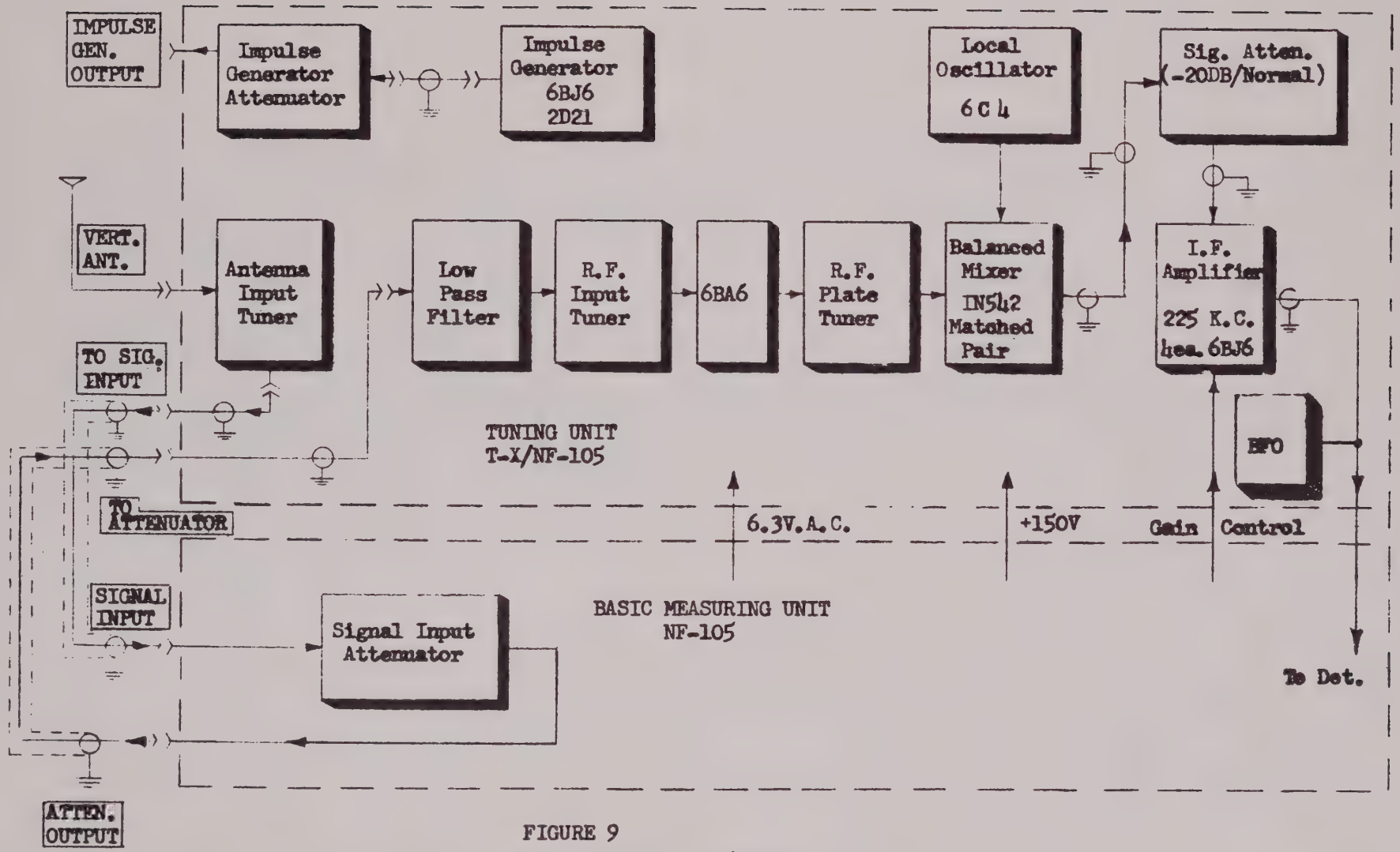


FIGURE 9
BLOCK DIAGRAM - TX/NF-105

10. PARTS LIST FOR TUNING UNIT

MODEL T-X/NF-105

I. CAPACITORS

Ref. Symbol	Description	Part of
C900-A	13.1-455.3 mmf, variable air	Ant. Input Ckt.
C900-B	13.1-455.3 mmf, variable air	R.F. Amp. Grid. Ckt.
C900-C	13.1-455.3 mmf, variable air	R.F. Amp.
C900-D	8.8-209.8 mmf, variable air	Local oscillator
C901	5-25 mmf, ceramic trimmer	Ant. Input Ckt.
C902	5-25 mmf, ceramic trimmer	"
C903	5-25 mmf, ceramic trimmer	"
C904	110 mmf, 600V., dura mica	"
C905	.001 mf, 1000V, ceramic disc	Impulse Gen.
C906	.02 mf, 500V, ceramic disc	"
C907	56 mmf, ± 5%, 500V dur-mica	"
C908	.05 mf, 200V, ceramic disc	"
C909	12 mf, 350V, electrolytic	"
C910	22 mf, + 20%, 15V tantalex	"
C911	5-25 mmf, ceramic trimmer	R.F. Amp. Grid Ckt.
C912	5-25 mmf, ceramic trimmer	"
C913	5-25 mmf, ceramic trimmer	"
C914	.05 mf, 200V, ceramic disc	Impulse Gen.
C915	2020 mmf, 500V, ± 2%, dur-mica	"
C916	2020 mmf, 500V, ± 2%, dur-mica	"
C917	2020 mmf, 500V, ± 2%, dur-mica	"
C918	2020 mmf, 500V, ± 2%, dur-mica	"
C919	.047 mf, 200V, vitamin Q feed-thru	"
C920	.1 mf, 100V, vitamin Q feed-thru	"
C921	5-25 mmf, ceramic trimmer	R.F. Amp.
C922	5-25 mmf, ceramic trimmer	"
C923	5-25 mmf, ceramic trimmer	"
C924	.01 mf, ± 2%, 600V, dur-mica	Low Pass Filter
C925	.01 mf, ± 2%, 600V, dur-mica	"
C926	.039 mf, ± 5%, 600V, dipped mylar paper	"
C927	.01 mf, 250V, ceramic disc	225 KC I.F. Amp.
C928	500 mmf, 500V, ± 20%, ceramic feed-thru	"
C929	.001 mf, 1000V, ceramic	"
C930	500 mmf, ± 20%, 500V, ceramic feed-thru	"
C931	.01 mf, 250V, ceramic disc	"
C932	.01 mf, 250V, ceramic disc	"
C933	500 mmf, ± 20%, 500V, ceramic feed-thru	"
C934	.01 mf, 250V, ceramic disc	"
C935	.05 mf, 200V, ceramic disc	"
C936	820 mmf, ± 2%, 500V, dur-mica	"
C937	.001 mmf, 1000V, ceramic	"
C938	.01 mf, 1000V, ceramic disc	"
C939	500 mmf, ± 20%, 500V, ceramic feed-thru	"
C940	.01 mf, 250V, ceramic disc	"

I. CAPCITORS (continued)

Ref. Symbol	Description	Part Of
C941	5-25 mmf, ceramic trimmer	Local Oscillator
C942	5-25 mmf, ceramic trimmer	"
C943	5-25 mmf, ceramic trimmer	"
C944	820 mmf, ± 2%, 500V mica	225 KC I.F. Amp.
C945	.05 mf, 200V, ceramic disc	"
C946	820 mmf, ± 2%, 500V mica	"
C947	.001 mf, 1000V, ceramic	"
C948	.01 mf, 250V, ceramic disc	"
C949	.01 mf, 250V ceramic disc	"
C950	.01 mf, 250V ceramic disc	"
C951	500 mmf, ± 20%, 500V ceramic feed-thru	"
C952	.05 mf, 200V ceramic disc	"
C953	820 mmf, ± 2%, 500V, mica	"
C954	820 mmf, ± 2%, 500V, mica	"
C955	.01 mf, 250V, ceramic disc	"
C956	.01 mf, 250V, ceramic disc	"
C957	.05 mf, 200V, ceramic disc	"
C958	.01 mf, 250V, ceramic disc	"
C959	820 mmf, ± 2%, 500V, mica	"
C960	500 mmf, ± 20%, 500V, ceramic feed-thru	"
C961	500 mmf, ± 20%, 500V, ceramic feed-thru	"
C962	110 mmf, 500V, ceramic tubular	R.F. Amp. Grid Ckt.
C963	15 mmf, 300V, ceramic tubular	"
C964	15 mmf, 300V, ceramic tubular	"
C965	.1 mf, 100V, paper feed-thru	R.F. Amplifier
C966	.47 mf, 100V, paper tubular	"
C967	.05 mf, 200V, ceramic disc	"
C968	110 mmf, 300V, ceramic tubular	"
C969	15 mmf, 300V, ceramic tubular	"
C970	15 mmf, 300V, ceramic tubular	"
C971	.01 mf, 1000V, ceramic disc	"
C972	.047 mf, 200V paper feed-thru	"
C973	.05 mf, 200V ceramic disc	Local Oscillator
C974	150 mmf, ± 2%, 600V, dur-mica	"
C975	43 mmf, ± 2%, 600V, dur-mica	"
C976	47 mmf, ± 2%, 600V, dur-mica	"
C977	90 mmf, ± 2%, 600V, dur-mica	"
C978	80 mmf, ± 2%, 600V, dur-mica	"
C979	820 mmf, ± 2%, 500V, mica	"
C980	500 mmf, ± 20%, 500V, ceramic feed-thru	"
C981	.01 mf, 250 V, ceramic disc	225 KC I.F. Amp.
C982	500 mmf, ± 20%, 500V ceramic feed-thru	"
C983	.01 mf, 250V ceramic disc	"
C984	82 mmf, ± 5%, 500V, dur-mica	"
C985	.05 mf, 250V, ceramic disc	BFO
C986	150 mmf, ± 2%, 600V, dura mica	"
C987	1000 mmf, ± 2% 600V dura mica	"
C988	4.7 mmf, ± 10%, ceramic tubular	"

II. DIODES

Ref. Symbol	Description	Part of
CR900	1N34, germanium diode	Impulse Gen.
CR901)	1N542, germanium diode matched pair	Balanced Mixer
CR902)		

III. JACKS

Ref. Symbol	Description	Part of
J900	UG-290 A/U	Impulse Gen. Output
J901	Receptical, Type UHF	Vert. Ant.
J902	UG-291/U	To Sig. Input
J903	UG-291/U	To Attenuator
J904	UG-290 A/U	Ant. Input Ckt.
J905	UG-290 A/U	Low Pass Filter
J906	Connector, Coaxial - Type MB	Sig. Atten.
J907	Connector, Coaxial - Type MB	"
J908	UG-290 A/U	Impulse Gen. Atten.
J909	UG-1094/U	Impulse Gen.
J910	Connector, Coaxial - Type MB	225 KC I.F. Amp.
J911	Connector, Female; Coaxial Plug in	I.F. Amp. Output
J912	Connector, Pin, Female	Main Unit
J913	Connector, Coaxial - Type MB	BFO

IV. INDUCTORS

Ref. Symbol	Description	Part of
L900	B+ Filter Coil; A-5302	Impulse Gen.
L901*	Impulse Gen. Delay Line Coil; A-5314	"
L902	Band 3 High Impedance Input; B-5286	Ant. Input Ckt.
L903	Band 2 High Impedance Input; B-5279	"
L904	Band 1 High Impedance Input; B-5351	"
L905*	Impulse Gen. Delay Line Coil; A-5314	Impulse Gen.
L906*	Impulse Gen. Delay Line Coil; A-5314	"
L907*	Impulse Gen. Delay Line Coil; A-5314	"
L908	Filament Filter Coil; A-5302	"
L909	Low Pass Filter Coil (series); B-5185	Low Pass Filter
L910	Low Pass Filter Coil (series); B-5185	"
L911	Low Pass Filter Coil (shunt); B-5191	"
L912	Band 3 Low Impedance Input; B-5286	R.F. Amp. Grid Ckt.
L913	Band 2 Low Impedance Input; B-5279	"
L914	Band 1 Low Impedance Input; B-5351	"
L915	Low Pass Filter Coil (shunt); B-5191	Low Pass Filter
L916	Balanced Mixer Coil; B-5311	Balanced Mixer
L922	Band 3 R.F. Amp. Plate Coil; B-5287	R.F. Amp.
L923	Band 2 R.F. Amp. Plate Coil; B-5280	"
L924	Band 1 R.F. Amp. Plate Coil; B-5352	"
L940	Band 1 Oscillator Coil; B-5292	Local Oscillator
L941	Band 2 Oscillator Coil; B-5293	"
L942	Band 3 Oscillator Coil; B-5288	"
L943	BFO Oscillator Coil; A-21729	BFO

* Separate coils wrapped on same form

V. PILOT LAMPS

Ref. Symbol	Description	Part Of
LP900	Lamp No. 47	R.F. Tuner
LP901	Lamp No. 47	"
LP902	Lamp No. 47	"

VI. PLUGS

Ref. Symbol	Description	Part of
P904	UG-88/U	Ant. input Ckt.
P905	UG-88/U	Low pass Filter
P906	Plug Coaxial, Type MB	Sig. Atten.
P907	Plug Coaxial, Type MB	" "
P908	UG-88/U	Impulse Gen. Atten.
P909	UG-88/U	Impulse Gen.
P910	Plug Coaxial, Type MB	225 KC I.F. Amp.
P913	Plug Coaxial, Type MB	BFO

VII. RESISTORS

Ref. Symbol	Description	Part Of
R901	24.9 ohms, 1/8W, 1%, Prec. Res. Dep. Carbon	Impulse Gen. Atten
R902	24.9 " " " " " " "	"
R903	71.5 " " " " " " "	"
R904	71.5 " " " " " " "	"
R905	71.5 " " " " " " "	"
R906	71.5 " " " " " " "	"
R907	71.5 " " " " " " "	"
R908	71.5 " " " " " " "	"
R909	5.76 " " " " " " "	"
R910	5.76 " " " " " " "	"
R911	5.76 " " " " " " "	"
R912	5.76 " " " " " " "	"
R913	5.76 " " " " " " "	"
R914	5.76 " " " " " " "	"
R915	5.76 " " " " " " "	"
R916	5.76 " " " " " " "	"
R917	5.76 " " " " " " "	"
R918	5.76 " " " " " " "	"
R919	95.3 " " " " " " "	"
R920	48.7 " " " " " " "	"
R921	48.7 " " " " " " "	"
R922	48.7 " " " " " " "	"
R923	48.7 " " " " " " "	"
R924	48.7 " " " " " " "	"
R925	33.2 " " " " " " "	"
R926	866 " " " " " " "	"
R927	432 " " " " " " "	"
R928	432 " " " " " " "	"
R929	432 " " " " " " "	"
R930	432 " " " " " " "	"

VII. RESISTORS (continued)

Ref. Symbol	Description	Part of
R931	432 ohms, 1/8W, ± 1%, Prec.Res.,Dep.Carbon	I.G. Atten.
R932	432 " " " " " " "	"
R933	432 " " " " " " "	"
R934	432 " " " " " " "	"
R935	432 " " " " " " "	"
R936	48.7 " " " " " " "	"
R937	1 meg., ½W, ± 10%, Resistor, Composition	Impulse Gen.
R938	2.2 meg.," " " "	"
R939	22K, " " " "	"
R940	220K ohms, ½W, ± 10%, Resistor, Composition	"
R941	10K, " " " "	"
R942	470K, " " " "	"
R943	2.2K ohms, ½W, ± 5%, Res. Comp.	"
R944	47 ohms, ½W, ± 5%, Resistor, Composition	"
R945	470 ohms, ½W, ± 10%, Resistor, Composition	"
R946	1.2K ohms, ½W, ± 10%, " "	Balanced Mixer
R947	1.2K ohms, " " " "	"
R948	470 ohms, " ± 5%, " "	"
R949	150 ohms, " " " "	"
R950	51 ohms " " " "	"
R951	100K, ½W, ± 10% " "	225 KC I.F. Amp.
R952	100K, " " " "	"
R953	1 meg., ½W, ± 10% " "	"
R954	390 ohms, ½W, ± 10% " "	"
R955	47K, ½W, ± 10% " "	"
R956	1 meg., ½W, ± 10% " "	"
R957	1K, ½W, ± 10% " "	"
R958	220K, ½W, ± 10% " "	"
R959	390 ohms, ½W, ± 10% " "	"
R960	47K, ½W, ± 10% " "	"
R961	470 ohms, ½W, ± 10% " "	"
R962	1 meg., ½W, ± 10% " "	"
R963	220K, ½W, ± 10% " "	"
R964	390 ohms, ½W, ± 10% " "	"
R965	47K, ½W, ± 10% " "	"
R966	470 ohms, 1W, ± 10% " "	"
R967	220K, ½W, ± 10% " "	"
R968	680 ohms, ½W, ± 10% " "	"
R969	10K, ½W, ± 10% " "	"
R970	560K, ½W, ± 10% " "	R.F. Amp. Grid Ckt
R971	220 ohms, ½W, ± 10% " "	R.F. Amp.
R972	10K, ½W ± 10% " "	"
R973	1.2K, ½W, ± 10% " "	"
R974	2.2K, ½W, ± 10% " "	Local Oscillator
R975	7500 ohms, 10W, ± 10% Wire Wound	+ 150V Line
R976	22K, ½W, ± 10%, Resistor, Composition	Local Oscillator
R977	82 ohms, ½W, ± 5%, Resistor, Composition	Impulse Gen.
R978	220 ohms, ½W, ± 10%, Resistor, Composition	R.F. Amp.
R980	220 ohms, ½W, ± 10%, Resistor, Composition	Mixer
R981	1.2K, ½W, ± 10%, Resistor, Composition	BFO
R982	47K, ½W, ± 10%, Resistor, Composition	BFO

VIII. SWITCHES

Ref. Symbol	Description	Part of
S900-A	Wafer Switch, Sect. #1, A-5174	R.F. Input Ckt.
S900-BF	Wafer Switch, Sect. #2 Front, A-5294	Ant. Input Ckt.
S900-BR	Wafer Switch, Sect. #2 Rear, A-5294	"
S900-CF	Wafer Switch, Sect. #2 Front, A-5199	R.F. Amp.Grid Ckt.
S900-CR	Wafer Switch, Sect. #2 Rear, A-5199	"
S900-DF	Wafer Switch, Sect. #3 Front, A-5199	R.F. Amp.
S900-DR	Wafer Switch, Sect. #3 Rear, A-5199	"
S900-EF	Wafer Switch, Sect. #4 Front, A-5199	"
S900-ER	Wafer Switch, Sect. #4 Rear, A-5199	"
S900-FF	Wafer Switch, Sect. #5 Front, A-5199	"
S900-FR	Wafer Switch, Sect. #5 Rear, A-5199	"
S901	SP-DT, Miniature Toggle Switch	Sig. Atten. (-20DB--Normal)
S902-A & B	Wafer Switch, Sect. #1 Front & 2 Rear,A-4964	Impulse Gen. Atten.
S903	Wafer Switch, Sect. #3 Rear, A-4964	"
S904	ST-42A, SP-ST, Toggle Switch	Impulse Gen. On-Off
S905	SP-DT Miniature Toggle Switch	BFO On-Off

IX. TRANSFORMERS

Ref. Symbol	Description	Part of
T900	I.F. Transformer, Input; C-5194	225 KC I.F. Amp.
T901	I.F. Transformer, Interstage; C-5194	"
T902	I.F. Transformer, Interstage; C-5194	"
T903	I.F. Transformer, Output; A-5188	"

X. TUBES

V900	NE-2	Impulse Gen.
V901	6BA6	R.F. Amp.
V902	6C4	Local Oscillator
V903	6BJ6	225 KC I.F. Amp.
V904	6BJ6	"
V905	6BJ6	"
V906	6BJ6	"
V907	6BJ6	Impulse Gen.
V908	2D21	"
V909	6C4	BFO Oscillator

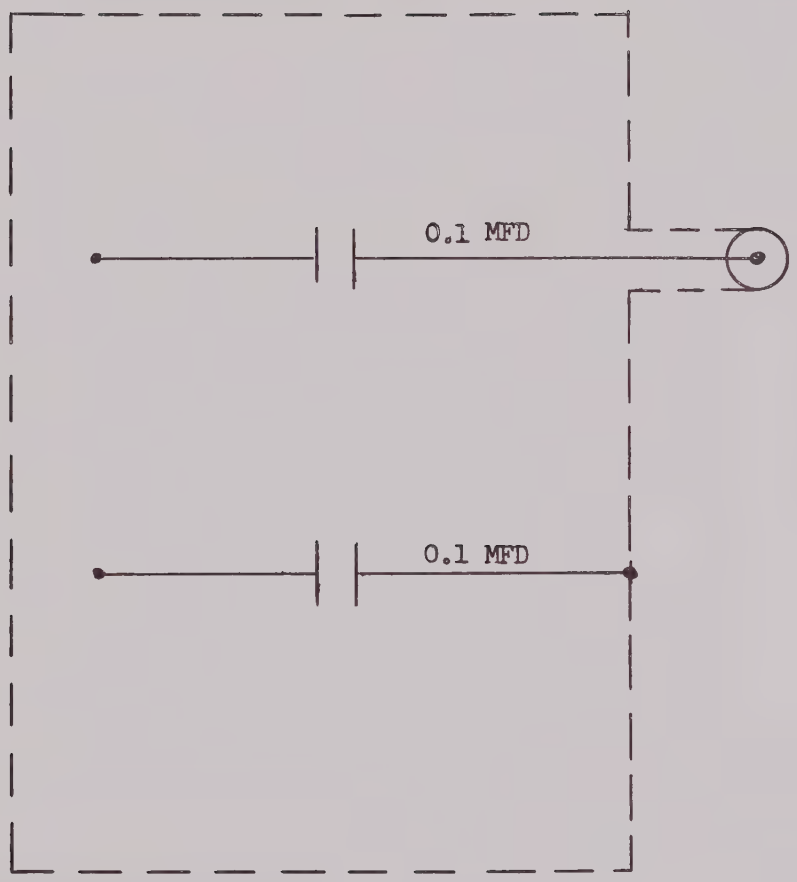


FIGURE 10
SCHEMATIC DIAGRAM
14 KC TO 150 KC
LINE PROBE
(PART OF ANTENNA EQUIPMENT LX-105)

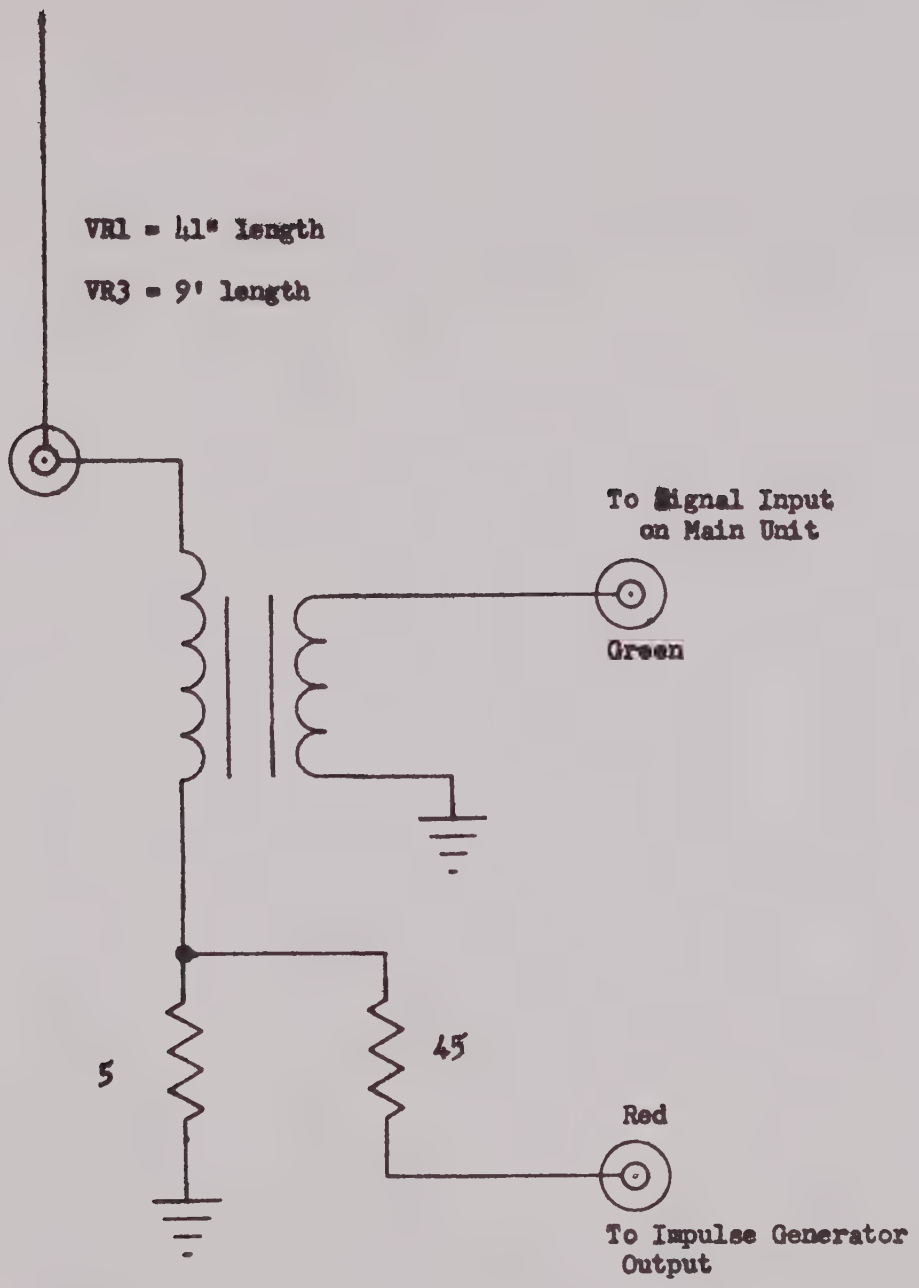


FIGURE 11
SCHEMATIC - REMOTE VERTICAL ANTENNA VR-105

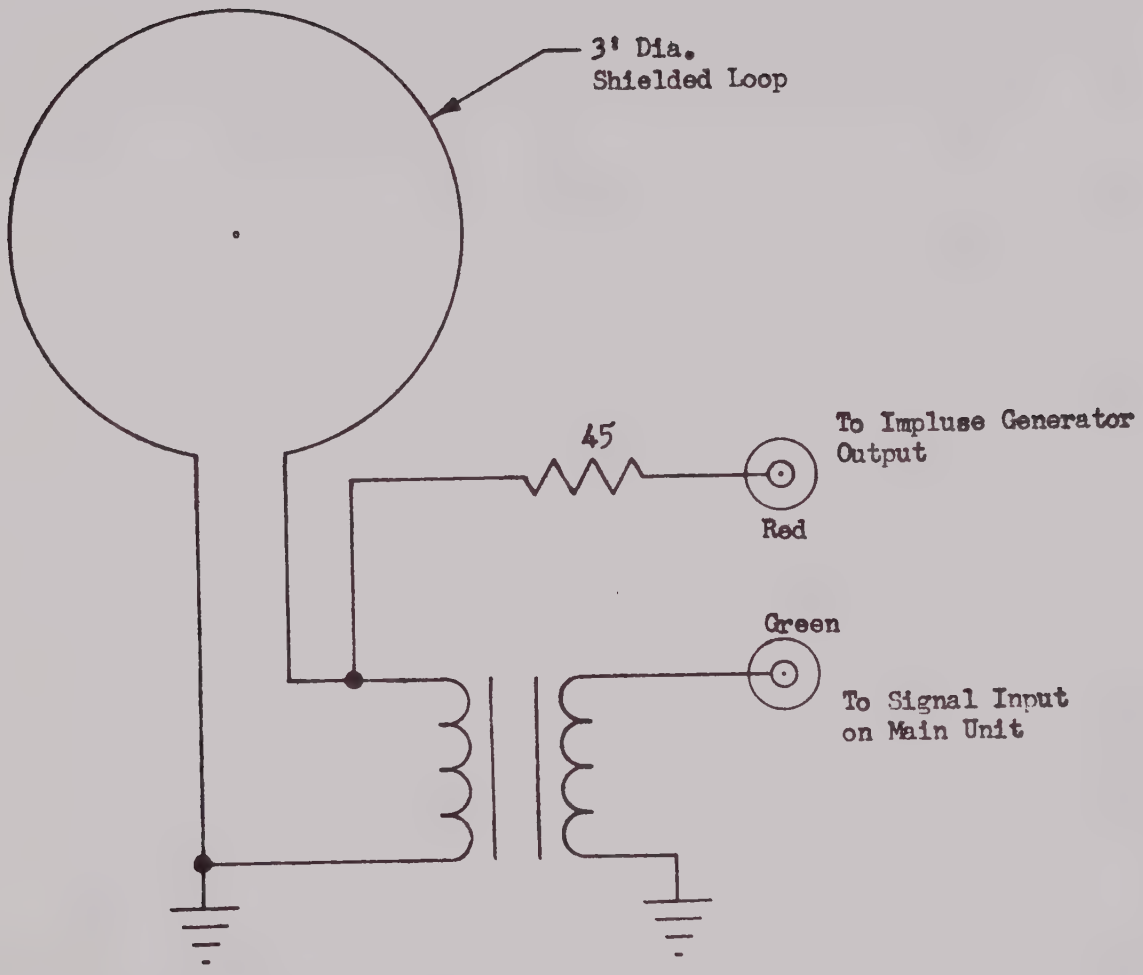
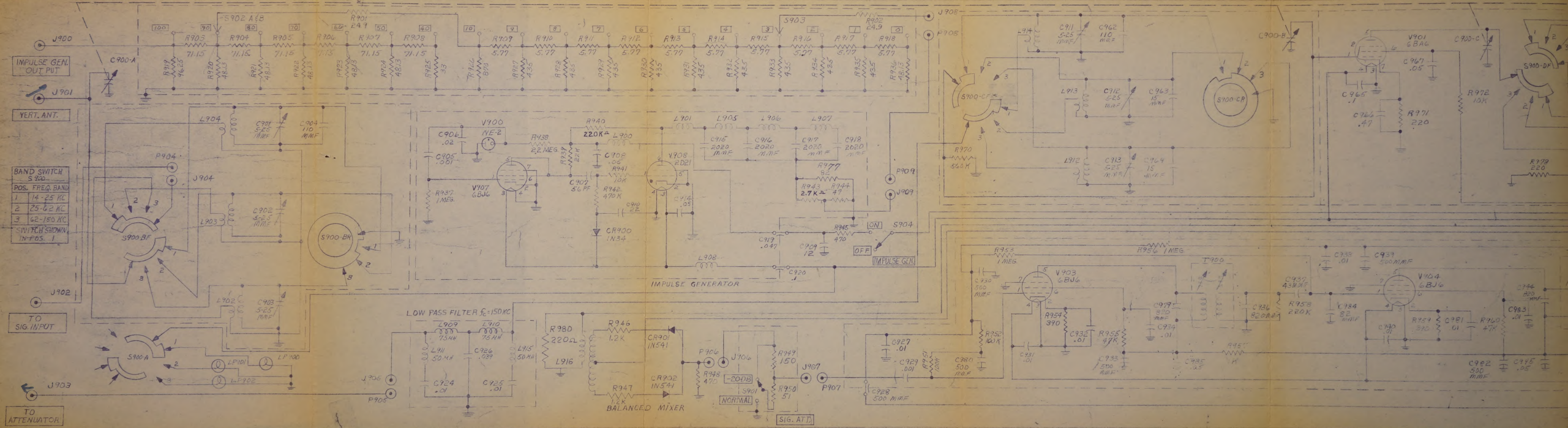
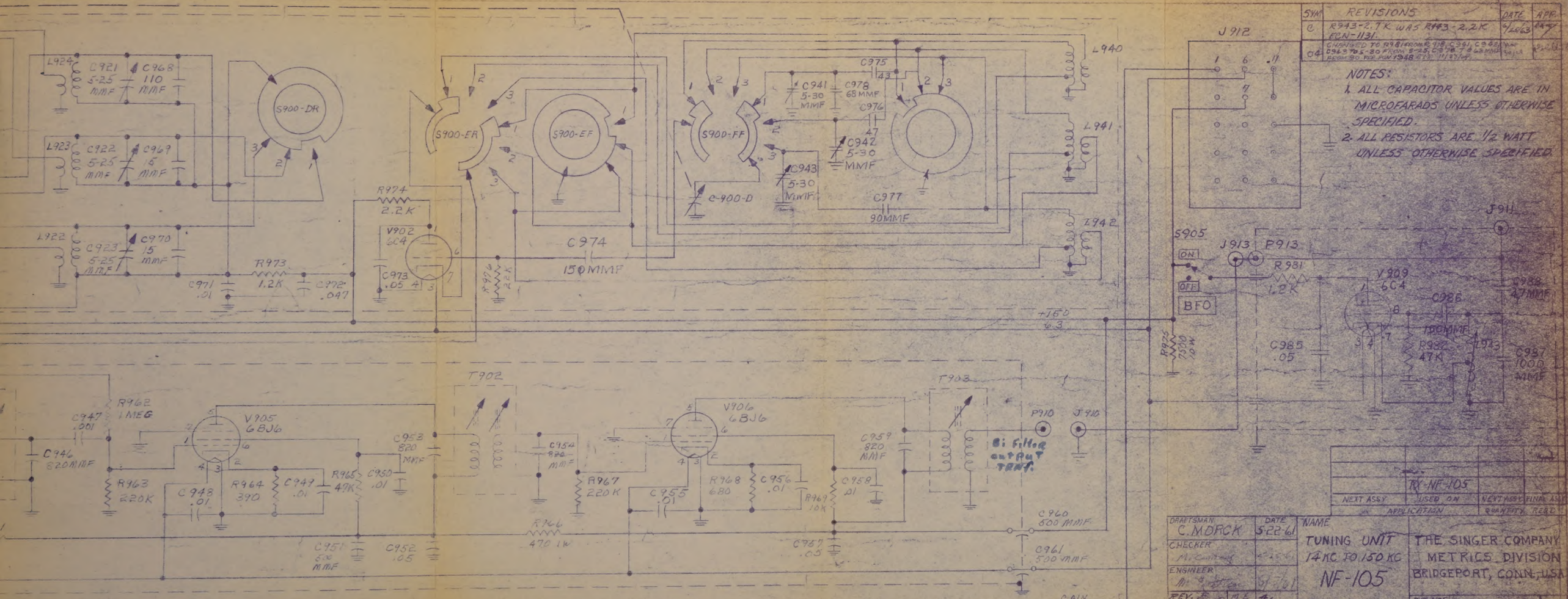


FIGURE 12

SCHEMATIC DIAGRAM
LOOP ANTENNA LG-105-A


J900
IMPULSE GEN. OUT PUT
J901
VERT. ANT.
J902
TO SIG. INPUT
J903
TO ATTENUATOR
J904
J905
J906
J907
J908
P904
P905
P906
P907
P908
P909
C900-A
C900-B
C900-C
S900-A
S900-BF
S900-BR
S900-CF
S900-CR
S900-DF
S902 A&B
S903
S901
S904
ON
OFF
IMPULSE GEN.
NORMAL
-20DB
SIG. ATT.
BAND SWITCH S 900
POS. FREQ. BAND
1 14-25 KC
2 25-62 KC
3 62-150 KC
SWITCH SHOWN IN POS. 1
IMPULSE GENERATOR
LOW PASS FILTER fc=150KC
BALANCED MIXER
V900 NE-2
V901 6BA6
V903 6BJ6
V904 6BJ6
V907 6BJ6
V908 6D21
L900
L901
L902
L903
L904
L905
L906
L907
L908
L909 75MH
L910 75MH
L911 50MH
L915 50MH
L916
L914
L912
L913
CR900 IN34
CR901 IN541
CR902 IN541
LP701
LP702
T900
R900 24.9
R901 24.9
R902 24.9
R970 560K
R971 220
R972 10K
R973 220
C900-A
C900-B
C900-C
C902 525 MMF
C903 525 MMF
C904 110 MMF
C905 .001
C906 .02
C907 56 PF
C908 .06
C909 12
C910 .05
C911 525 MMF
C912 525 MMF
C913 525 MMF
C914 525 MMF
C915 2020 MMF
C916 2020 MMF
C917 2020 MMF
C918 2020 MMF
C919 .047
C920
C922 22
C924 .01
C925 .01
C926 .039
C927 .01
C928 500 MMF
C929 .001
C930 500 MMF
C931 .01
C932 .01
C933 500 MMF
C934 .01
C935 .05
C936 820 MMF
C937 500 MMF
C938 .01
C939 .01
C940 .01
C941 .01
C942 110 MMF
C943 15 MMF
C944 15 MMF
C945 .05
C946 .1
C947 .47
C948 .01
C949 .01
C950 .01
C951 .01
C952 500 MMF
C953 .1
C954 500 MMF
C955 .01
C956 .01
C957 .01
C958 .01
C959 .01
C960 .01
C961 .01
C962 500 MMF
C963 .05
C964 .05
C965 .1
C966 .47
C967 .05
C968 .01
C969 .01
C970 .01
C971 .01
C972 .01
C973 .01
C974 .01
C975 .05
C976 .01
C977 .01
C978 .01
C979 .01
C980 .01
C981 .01
C982 500 MMF
C983 .01
C984 82 MMF
R900 24.9
R901 24.9
R902 24.9
R903 71.15
R904 71.15
R905 71.15
R906 1.13
R907 71.15
R908 71.15
R909 5.79
R910 5.79
R911 5.79
R912 5.79
R913 5.79
R914 5.79
R915 5.79
R916 5.79
R917 5.79
R918 5.79
R919 8.33
R920 48.13
R921 48.13
R922 48.13
R923 49.9
R924 48.13
R925 33
R926 8.33
R927 4.35
R928 4.35
R929 4.35
R930 4.35
R931 4.35
R932 4.35
R933 4.35
R934 4.35
R935 4.35
R936 48.13
R937 1MEG.
R938 2.2MEG.
R939 22K
R940 220K
R941 10K
R942 470K
R943 2.7K
R944 47
R945 470
R946 1.2K
R947 1.2K
R948 470
R949 150
R950 51
R951 100K
R952 100K
R953 1MEG.
R954 390
R955 47K
R956 1MEG.
R957 47K
R958 220K
R959 47K
R960 47K
R961 1M
R962 1M
R963 1M
R964 1M
R965 1M
R966 1M
R967 1M
R968 1M
R969 1M
R974 1M
R975 1M
R976 1M
R977 82
R978 1M
R979 220
R980 220Ω
L916


L924
C921 5-25 MMF
C968 110 MMF
L923
C922 5-25 MMF
C969 15 MMF
L922
C923 5-25 MMF
C970 15 MMF
S900-DR
S900-ER
S900-EF
S900-FF
S900-D
R974 2.2K
V902 6C4
C973 .05
R976 2.2K
C971 .01
R973 1.2K
C972 .047
C974 150 MMF
C941 5-30 MMF
C978 68 MMF
C976 47
C942 5-30 MMF
C943 5-30 MMF
C975 43
C977 90MMF
L940
L941
L942
J912
NOTES:
1. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
J911
S905
ON
OFF
BFO
J913
P913
R981 1.2K
V909 6C4
C986 150MMF
C982 47MMF
R982 47K
C983
C987 1000 MMF
C985 .05
R825 2500 10W
+165 6.3
C947 .001
R962 1 MEG
V905 6BJ6
C946 820MMF
R963 220K
C948 .01
R964 390
C949 .01
R965 47K
C950 .01
C953 820 MMF
C951 500 MMF
C952 .05
T902
C954 820 MMF
R966 470 1W
T903
V906 6BJ6
R967 220K
C955 .01
R968 680
C956 .01
R969 10K
C957 .05
C958 .01
C959 820 MMF
Bi Filar output TRANF.
P910
J910
C960 500 MMF
C961 500 MMF
GAIN
NF-105
NEXT ASSY
USED ON
NEXT ASSY
FINAL ASSY
APPLICATION
QUANTITY REQ'D
SYM
REVISIONS
DATE
APP.
C
R943-2.7K WAS R943-2.2K ECN-1131.
6/26/63
04
CHANGED TO R981 FROM C918, C941, C942, C943 705-30 FROM 8-25, C978 TO 68 MMF FROM 90 PER ECN 1948
4/30/62
DRAFTSMAN C.M.DACK
DATE 5-22-61
CHECKER
ENGINEER
REV. LTR
PROD. REL
PROD. APP'D
M.E.
4/30-62
NAME
TUNING UNIT 14 KC TO 150 KC
NF-105
FIGURE No. 13
THE SINGER COMPANY METRICS DIVISION BRIDGEPORT, CONN., U.S.A.
CODE IDENT NO. 05339
SIZE R
DRAWING NO. 04
APR. 30-1962
REF 5339